ASCIDIANS COLLECTED DURING THE MELANESIA EXPEDITION OF THE OSAKA MUSEUM OF NATURAL HISTORY -I. ASCIDIANS PRESENTED BY DR. R. L. A. CATALA OF THE AQUARIUM OF NOUMEA-

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ASCIDIANS COLLECTED DURING THE MELANESIA EXPEDITION OF THE ÔSAKA MUSEUM OF NATURAL HISTORY

I. ASCIDIANS PRESENTED BY DR. R. L. A. CATALA OF THE AQUARIUM OF NOUMEA[1,2]

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With Plate V and 15 Text-figures

During my stay at Noumea, New Caledonia, in the autumn of 1958, I often visited the Aquarium of Noumea to enjoy the beautiful collection of marine animals of the tropical sea and had fortunately a chance to see Dr. R. L. A. CATALA who established this aquarium and asked him for some specimens of ascidians. Very generously, Dr. CATALA offered me all the specimens he had kept in his laboratory. These include fourteen species listed below.

1. *Polyclinum constellatum* SAVIGNY
2. *Didemnum* (*Didemnum*) *moseleyi* (HERDMAN)
3. *Ascidia gemmata* SLUITER
4. *Ascidia sydneiensis samea* (OKA)
5. *Phallusia julinea* SLUITER
6. *Botryllus gracilis* MICHAELSEN
7. *Symplegma oceania* n. sp.
8. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* n. sp.

8*a*. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* f. *solitaria* nov.

9. *Polycarpa cryptocarpa* (SLUITER)
10. *Polycarpa aurata* f. *clavata* HARTMEYER
11. *Cnemidocarpa areolata* (HELLER)
12. *Styela partita* (STIMPSON)
13. *Herdmania momus* (SAVIGNY)
14. *Microcosmus* sp. aff. *multiplicatus* TOKIOKA

1) Scientific Results of the Melanesia Expedition, No. 9.
2) Contributions from the Ôsaka Museum of Natural History, No. 69 and Contributions from the Seto Marine Biological Laboratory, No. 363.

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Ascidia sydneiensis samea, Phallusia julinea, Herdmania momus and *Microcosmus* sp. aff. *multiplicatus* were included in the collection made by Dr. CATALA himself, while *Polycarpa aurata* f. *clavata* was collected by Dr. YVES MERLET by diving and twelve species exclusive of *Phallusia julinea* and *Polycarpa aurata* f. *clavata* were found in the samples collected by Mr. ROLLAND from the bottom of a vessel. I want to express here my hearty thanks to Dr. CATALA for his kindness in submitting these specimens to my examination.

1. *Polyclinum constellatum* SAVIGNY, 1816

(Pl. V, fig. 1; Text-fig. 1)

Seven large colonies, up to 70 mm×50 mm in extent, and fourteen small ones in the collection. They are encrusting or massive, and the thickness or height varies in the range from 4 mm to 25 mm. The test is soft gelatinous, translucent, and brownish, dark purplish brown or purplish black in colour in preservation. The surface is generally smooth or marked with slight elevations and depressions arranged irregularly; it is usually free from any foreign materials, although sometimes it is sparsely encrusted with fine sand grains. Systems of the arrangement of zooids cannot be discerned clearly on preserved specimens; they must be very complicated as the atrial languet of zooid is very elongate. There are several oval common cloacal apertures on the surface of the colony, they are 0.5 mm to 3 mm in diameter. The zooidal layer is about 5 mm thick. The living colonies are coloured greenish gray or orange red and the branchial apertures are marked each with six prominent lobes.

Zooid: Thorax is about 1.5 mm in length, abdomen is about 1 mm long, and postabdomen may often be longer than abdomen. About seven longitudinal muscles on each side of thorax. Stigmatal rows are 14 to 17, most frequently 16; sometimes the stigmatal rows are one more on the left side than on the right side. Twelve to sixteen stigmata in each row, dorsal languets are slightly displaced to the left side from the dorso-median line. Anus is bilobed and opened at the level of the 8 th or the 9 th transverse vessel. Tentacles of the first and the second orders are 16, in addition to them smaller ones of the third order intervene between larger ones; thus the arrangement of large-small-medium-small-large is seen in most zooids. Ciliated groove is a small oval opening. Both hind-stomach and middle intestine are defined distinctly. Up to 20 testicular follicles in postabdomen, ovary is situated at the centre of the gonad. Embryos in the incubatory chamber are less than two in examined zooids, they are 410–550μ in length and provided with three attachment processes arranged linearly and four pairs of ampullae. Pigment flecks of the sensory organ are arranged antero-posteriorly or slightlly obliquely. Larval test is granulated.

There is another small colony, 12 mm×7 mm in extent and 4 mm in thickness

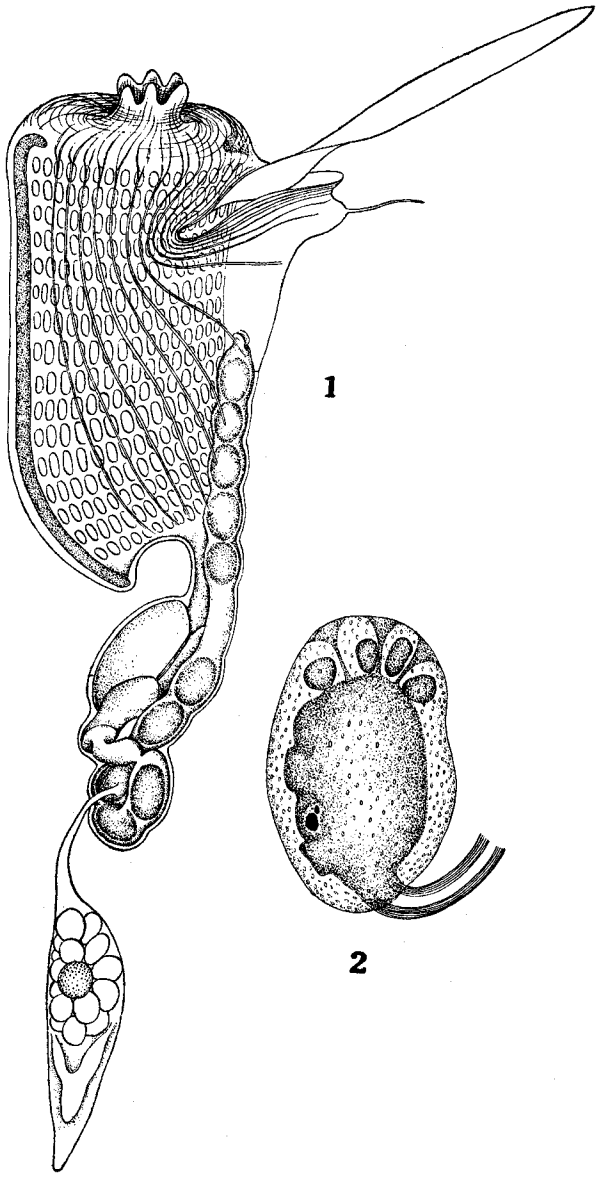


Fig. 1. *Polyclinum constellatum* SAVIGNY. 1—Left side of a zooid, 2—Right side of an embryo, ×73.

The test is soft gelatinous, milky-white and translucent so that brownish zooids are seen through. The surface is smooth and quite free from any foreign materials. The type of systems found in the arrangement of zooids is hardly discriminated on the colony surface, although they do not seem to be stellate. Thorases are 1.5 mm in length and abdomens are about half as long as thorases. The arrangement of the thoracic musculature is quite the same as that mentioned above. Atrial languet is of a moderate length. A small 700μ long thorax is found having 9 stigmatal rows, each carrying ca. 8 stigmata on each side; but usually there are 12–14 stigmatal rows in larger zooids and about 13 stigmata are found in each row. Anus is located at the 8th transverse vessel in zooids with 14 stigmatal rows. Although the existence of fewer stigmatal rows in smaller zooids reminds us of *P. tsutsuii* TOKIOKA known from the tropical and subtropical areas of the North West Pacific, this colony may represent most probably a young colony of *P. constellatum.*

2. *Didemnum* (*Didemnum*) *moseleyi* (HERDMAN), 1886

(Text-fig. 2)

Many colonies encrusting the nest tubes of a polychaete and barnacles, the largest one of which is about 80 mm×50 mm in extent. They are irregularly lobated end the surface is quite uneven. They are thin, mostly less than 1 mm

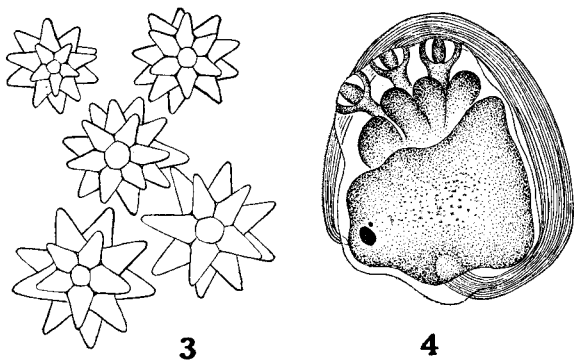


Fig. 2. *Didemnum* (*Didemnum*) *moselyi* (HERDMAN). 3—Spicules, ×440; 4—Right side of an embryo, ×73.

in thickness. The surface is slightly grayish white in colour and in some colonies, it is divided by grooves into a number of small areas. Systems indiscernible, branchial apertures are marked with six lobules The superficial spiculeless layer is not defined in these colonies. Spicules are distributed densely in the surface layer of the thoracic stratum, but very sparsely in other layers, so that the

underside of the colony looks yellowish brown. Spicules rather small and stellate in shape, 24–44μ in diameter and with an average of 33μ; rays on the equatorial plane are usually 8–10, sometimes up to 12.

Thorax is 580–690μ long and with an average of 650μ, abdomen is up to 550μ in length. Atrial aperture very wide. About six stigmata in each of four rows. Testicular follicle one, the proximal end of the vas deferens coils about five times. Embryos are about 450μ in length and with three cup-shaped attachment processes arranged lineally and furnished at the basse with four pairs of ampullae; pigment flecks of the sensory organ arranged obliquely.

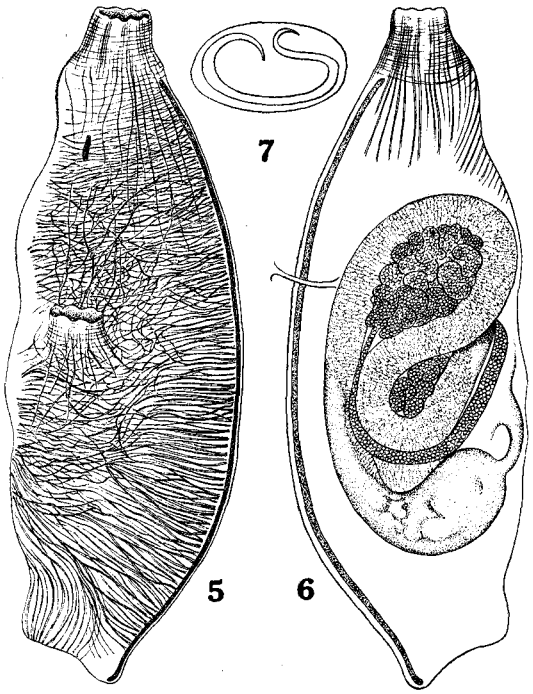


Fig. 3. *Ascidia gemmata* SLUITER. 5—Right side of the mantle body of a 50 mm long individual, 6—Left side of the same mantle body, 7—Ciliated groove of the same individual.

3. *Ascidia gemmata* SLUITER, 1895

(Text-fig. 3)

Four specimens in the material, they are respectively 13, 23, 35 and 50 mm in length. The animal is oval in shape, flattened laterally and attached to the substratum by the whole left side. The test is rather hard gelatinous, translucent, faintly milky white in colour and thicker than in next *A. sydneiensis samea.*

The surface is originally smooth, but becomes rather irregular, probably because of contraction and at the same time by being fouled with creeping hydrozoan colonies; it is papillated (?) in some specimens. Branchial siphon terminal; atrial siphon is situated at the level of the posterior one-third in three smaller specimens, but in the largest 50 mm long specimen it is located with the posterior edge of its base at the middle. Siphons are short in the present specimens. The right surface of the mantle body is wholly reticulated with fine muscles chiefly consisting of transverse ones in the postero-ventral portion. The dorsal ganglion is apart from the ciliated groove for the distance approximately two times the ganglion length. Seven or eight ocelli at the branchial and six ones at the atrial aperture. Tentacles ca. 50 in the largest specimen, the order of large-small-medium-small-large may be discerned at some places; ciliated groove is simply U-shaped. There are 206 transverse vessels on the right side of the branchial sac of the 50 mm long specimen; they are arranged in the order of thick-thin-medium-thin-thick and partially intervened by parastigmatic vessels; inner longitudinal vessels are 38 on the left and 41 on the right side in the same individual. Plications are not so remarkable, about six stigmata on each plication; no intermediate papillae are found. The dorsal lamina is ribbed, the distal end of ribs is protruded out beyond the edge of the lamina in the posterior part. The anterior end of the intestinal loop reaches the middle of the range in front of the atrial siphon. The second intestinal loop is very deep with its axis passing through the proximal part of the intestine considerably apart from the pyloric end of the roughly globular stomach. The oesophagus opens to the branchial sac at the level of the anterior one third of the range behind the atrial siphon. The ovary is coloured in a characteristic dark purplish nuance.

4. *Ascidia sydneiensis samea* (OKA), 1935

(Text-fig. 4)

There are 12 specimens ranging from 11 mm to 71 mm in body length. The body is oval in outline, laterally compressed and attached to the substratum by the whole left side of the body. The test is hard gelatinous, usually milky white, translucent or transparent and very thin, being less than 1 mm even in larger specimens. The surface seems originally to be smooth, but usually it is furnished with many irregularly formed prominences by which the animal attaches to other objects to keep its position and sometimes it becomes yellowish brown by being fouled with various organisms. The branchial siphon terminal, the atrial is situated at the middle of the body or nearby with the posterior edge of its base at the middle. Both siphons are fairly long; the atrial aperture is 6-lobed, while the branchial is 7-9 lobed; the margin of each lobe is pectinated. Mantle

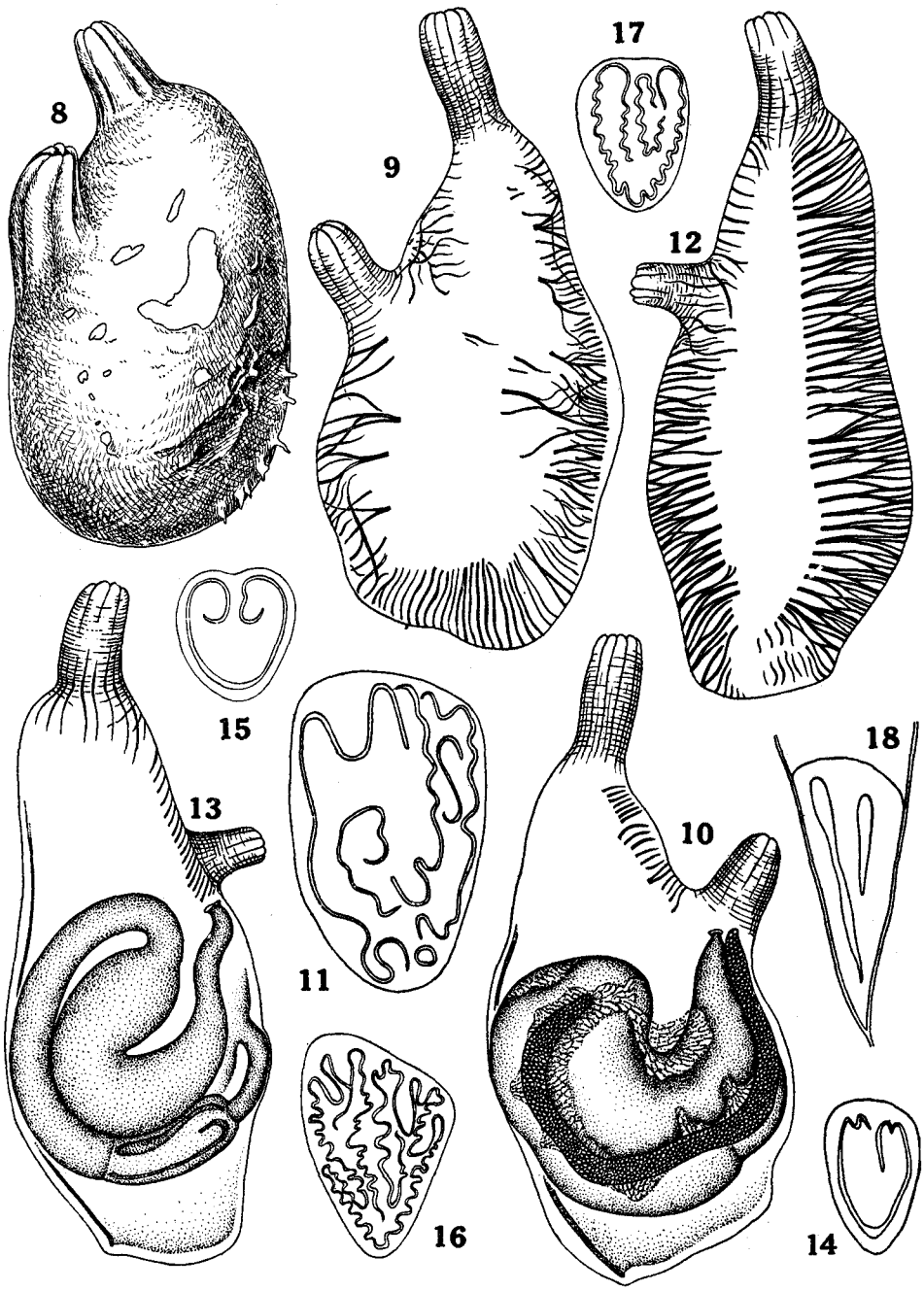


Fig. 4. *Ascidia sydneiensis samea* (OKA). 8—42 mm long specimen, 9—Right side of the mantle body of the same individual, 10—Left side of the same mantle body, 11—Ciliated groove of the same individual, 12—Right side of the mantle body of a 18 mm long individual, 13—Left side of the same mantle body, 14—Ciliated groove of the same individual, 15—Ciliated groove of a 19 mm long mantle body, 16—Ciliated groove of a 26 mm long mantle body, 17—Ciliated groove of a 42 mm long individual, 18—Ciliated groove of a 34mm long individual.

is grayish brown or dark brownish, the muscles are interrupted widely at the middle on the right side.

Body length	Tentacles	Transverse vessels	Longitudinal vessels
42 mm	ca. 100	129–130	48–52
42 mm	ca. 50*	—	47
34 mm	ca. 70*	133	49–51
18 mm	ca. 25*	70–70	37–42

* exclusive of minute ones.

Tentacles are 50–70 in grown ups when the larger and medium ones are counted, but they may be up to 100 when the smaller or minute ones intervening at intervals are counted together. The ciliated groove is U-shaped with both horns incurled in smaller (18 and 30 mm long) individuals, but it is undulating and complicated in larger specimens. The occurrence of a simple ciliated groove in the 34 mm long individual is rather unusual. There are about 130 transverse vessels on the branchial sac of grown up and usually 40–50 inner longitudinal vessels. Plications of the branchial sac are distinct, but not so remarkable, 4–6 stigmata (3 in smaller individuals) on each plication. Intermediate papillae absent. The dorsal lamina is ribbed, but the distal end of ribs does not project out beyond the margin of the lamina. The anterior end of the intestinal loop does not reach beyond the level of the base of the atrial siphon. The axis of the second intestinal loop passes through the pyloric portion of the stomach or the proximal portion of the intestine slightly apart from the pyloric end. Usually the bottom of the second intestinal loop is swollen remarkably in the present specimens. The stomach is elongate and smoothly surfaced, although a few plications of the inner wall may be seen through in some specimens. The 18 mm long individual is immature; but the specimens larger than 34 mm long are all matured; the ovary is borwnish in colour. Parasitic copepods were found in the branchial sac of some specimens and more frequently amphipods in the peribranchial cavity.

5. *Phallusia julinea* SLUITER, 1919

(Pl. V, fig. 2; Text-fig. 5)

A single 51 mm long specimen in the material. The animal is oval, laterally flattened and attached to the substratum by the whole left side. Test is rather thick, hard gelatinous, translucent and milky white in colour. The surface is generally smooth, but sparsely sprinkled with minute papillae. The test is wholly penetrated with many vessels ramified in a characteristic way ending in a number of blind terminals which are very frequently full of corpuscles. Branchial

aperture is terminal and the atrial is situated at the level of the anterior one third of the body length,, both apertures are sessile. Mantle is delicate, the right side is wholly reticulated with muscles. Both branchial and atrial apertures are 10-lobed, ocelli are brownish in the preserved specimen, and the edge of each lobe of apertures is pectinated. Both siphons are very short. Tentacles ca. 75 in all, the arrangement of large-small-medium-small-large can be seen at some plasces. The main ciliated groove is simply U-shaped. Dorsal ganglion is situated far apart from the ciliated groove, approximately for the distance six times as long as the ganlion's length. No secondary ciliated grooves were found on the present specimen. There are 65–70 inner longitudinal vessels on one side

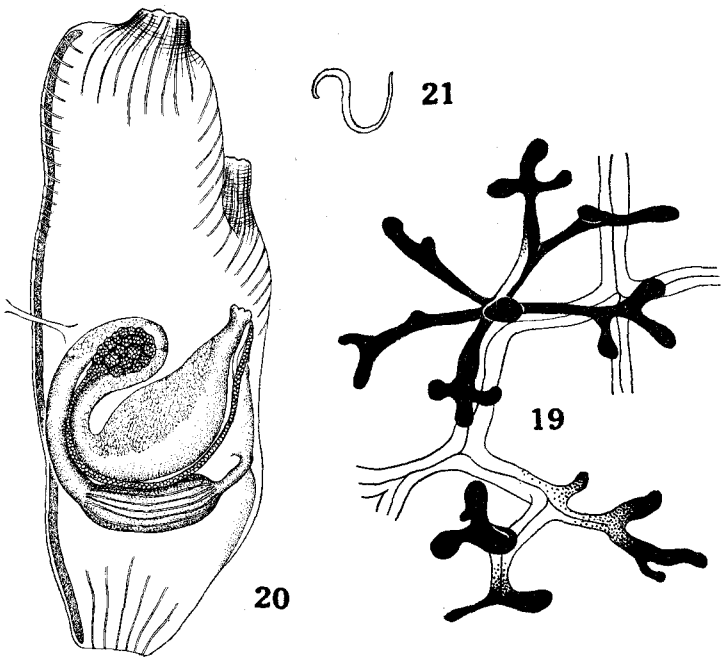


Fig. 5. *Phallusia julinea* SLUITER. 19—Vessels in the test, ×47; 20—Left side of the mantle body, 21—Ciliated groove.

and 181 transverse vessels on the right side of the branchial sac. About seven thinner vessels are found between each pair of thicker ones. Intermediate papillae absent. Plications of the branchial sac are inconspicuous, usually 3-4 stigmata at each interval between longitudinal vessels, but they may be up to 6 in the meshes found on rather strongly formed plications. Dorsal lamina is ribbed, the tip of ribs is protruded out beyond the edge of the lamina.

The anterior end of the intestinal loop does not reach the level of the base of the atrial siphon. The second loop is well defined and deep, the proximal half of the distal branch of the second loop is characteristically swollen; the axis

of the loop is passing through the proximal portion of the intestine somewhat apart from the pyloric end of the elongate stomach. About six longitudinal plications of the inner wall are seen through on the left side of the stomach. The oesophagus opens to the branchial sac at the level of the middle of the range behind the atrial siphon. The anal margin is undulating and forms several lobules.

6. *Botryllus gracilis* MICHAELSEN, 1927

(Text-fig. 6)

MICHAELSEN, W. (1927): Einige neue westaustralische Ptychobranchiate Ascidien. Zool. Anz., Bd. 71, p. 203.

HARTMEYER & MICHAELSEN (1928): Fauna Südwest-Australiens, Bd. 5, Lief. 6, pp. 338–341, text-figs. 22–23.

HASTINGS (1931): Great Barrier Reef Expedition 1928–29, Sci. Rep., Vol. 4, No. 3, pp. 77–79, text-fig. 4.

A considerable number of irregularly lobated colonies of various sizes encrusting barnacles and bivalves of the genus *Pinctada*. The largest one includes the portion about 30 mm×20 mm in extent and 3 mm thick, but this shows the thickness of the folded part consisting of double zooidal layers opening on respective surfaces at some liberated part of the colony and the real thickness seems to be 1.5 mm. The surface is smooth and quite free from any foreign matters. The test itself is soft, gelatinous and transparent, and the purplish brown zooids are seen through. The system of the arrangement of zooids is quite obscure, probably because of the contraction of zooids.

Zooid: Most zooids are situated obliquely. They are usually less than 1 mm in length, although very extended ones may reach 1.8 mm. Larger fully grown zooids are usually pigmented very heavily and provided with the atrial aperture so wide that most parts of the branchial sac and even a part of the stomach are exposed at the maximum, while smaller or medium-sized ones are pigmented much less densely and have the small artial aperture (figs. 22, 24). Stigmatal rows are most freqently 8 on the right and 9 on the left side, though rarely they may be up to 10. The dorsal edge of the second row does not reach the dorso-median line, falling in the distance of two or three stigmata to the median line. Stigmata are distributed in respective interspaces between three inner longitudinal vessels as D. 3–4 : 2–3 : 2–3 : 3–4 V. Tentacles are 16 at the maximum, comprising 4 large, 4 medium-sized and 8 small ones intervening at each intervals between the first two. The ciliated groove is an oval orifice. The anus is attached to the brancial sac at the level of the 7th or the 8th transverse vessel and then extended further to the level of the 6th or the 7th transverse vessel; the margin is plain. The stomach is nearly spherical and its posterior half is exposed beyond the posterior

margin of the branchial sac. Longtudinal plications on the stomach wall are most frequently 8 excluding the typhlosole, but rarely up to 9. The pyloric coecum is very large, strongly curved in a semicircular form and ending in a slightly swoollen tip. The intestine is rather short and stretched nearly straightly, the second intestinal loop is almost indiscernible. The proximal portion of the intestine adjoining to the stomach is slightly thinner than the following part and coloured differently. Gonads are seen most often on smaller zoooids and sometimes missing on one side. The left gonad is situated along the anterior margin

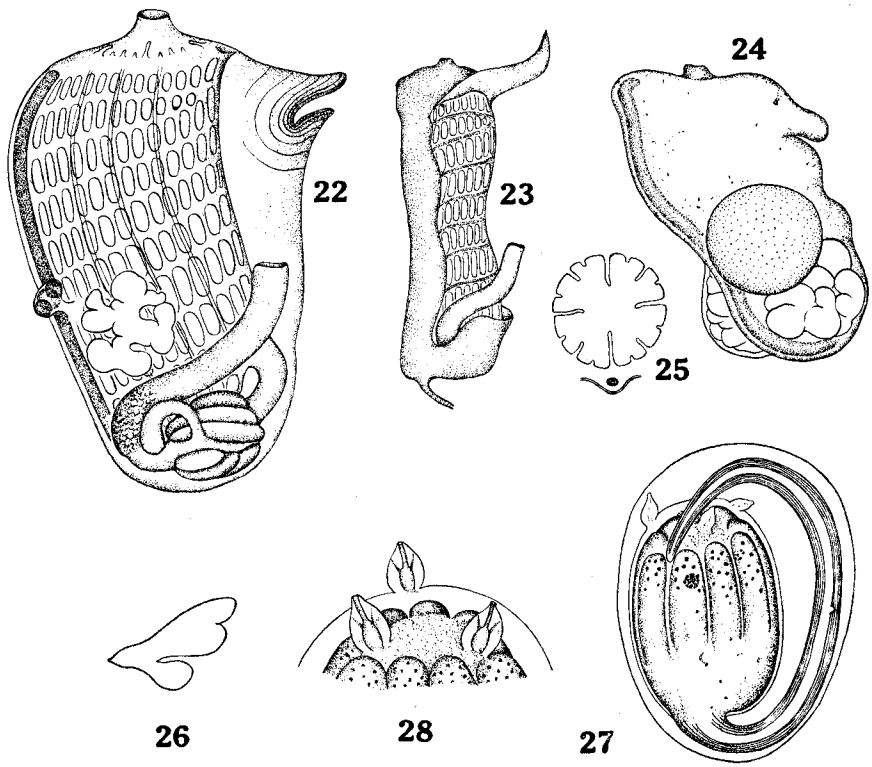


Fig. 6. *Botryllus gracilis* MICHAELSEN. 22—Left side of a young zooid, 23—Left side of an extended old zooid, 24—Young zooid with matured gonad, left side; 25—Tentacular ring and ciliated groove, 26—Left rudimentary testis, inner surface; 27—Embryo, ×73; 28—Attachment processes, magnified.

of the intestinal loop, while the right one is located more posteriorly, with its posterior edge at the level of the rear end of the branchial sac. Testicular follicles are 2–3 in younger stage, but may be up to 12 at maturity. The ovary is situated at the anterior side of the testis and always contains only a single matured ovum; the egg develops to the embryo at this situation. A bud is protruded out from each body side near the antero-ventral corner of the testis.

Larva: The trunk is ellipsoidal, 310–410μ in length and with an average of 350μ. Eight elongate ampullae are present. Three attachment processes are very prominent and arranged in a triangle. Pigment fleck of the sensory organ is situated slightly anteriorly to the middle of the trunk. Larval test is transparent, purplish brown pigments are deposited in the anterior part of the ampullae.

Remarks: The present colonies conform quite well to *Botryllus gracilis* described by MICHAELSEN (1928) and HASTINGS (1931). *Botryllus planus* (VAN NAME) has also a very conspicuous pyloric coecum and contains only a single mature ovum in the ovary, however this is provided with more stigmatal rows, usually 11–13, than in *B. gracilis*. Tentacles are 8 in *B. planus*. *Botryllus anceps* (HERDMAN) resembles the present species, too. It has 10–11 stigmatal rows on the branchial sac and 10 plications on the stomach. The difference between *B. anceps* and the present specimens is so exact that the identity of *B. gracilis* with *B. anceps* seems to be discussed fully in future on many specimens from various localities.

7. *Symplegma oceania* n. sp.

(Text-fig. 7)

Many colonies encrusting the nest tubes of a polychaetous annelid in a thickness of 2 mm. The surface of the colony is quite free from the foreign matters. The test is thin and transparent, but very tough in consistency. Zooids are oval in shape, up to 3 mm in length and covered by the purplish brown mantle which is sprinkled with reddish pigment spots on the dorsal side in some zooids. A thin reddish line encircles the branchial aperture opened subterminally. The atrial aperture is smaller than the brancial and situated approximately at the middle of the body. Both apertures are elongate along the sagittal axis of the body. Atrial tentacles are very fine. There are 13–14 stigmatal rows on the left and 13 rows on the right side on the ventral side, while 12–13 on the left and 12 on the right side on the dosal side. This difference is caused by the second row which falls in the distance of about six stigmata to the dorso-median line. Stigmata are divided by four inner longitudinal vessels into the following groups. D. 6–7 : 4–5 : 4–5 : 4–6 : 5–6 V ; parastigmatic vessels absent. Tentacles 8, larger and smaller ones alternate regularly. Ciliated groove is a roundish orifice. The intestinal loop covers about 6 posterior stigmatal rows and its anterior margin reaches the 7th transverse vessel. The distal part of the intestine turns up onto the dorsal side and the anus is usually attached to the seventh transverse vessel, but extended further freely to the level of the sixth transverse vessel; anal margin is plain. The stomach is globular in outline, occupies one half of the proximal branch of the intestinal loop and marked with 13 longitudinal plications on the surface. The pyloric coecum is stout, not curved and issues a vessel from

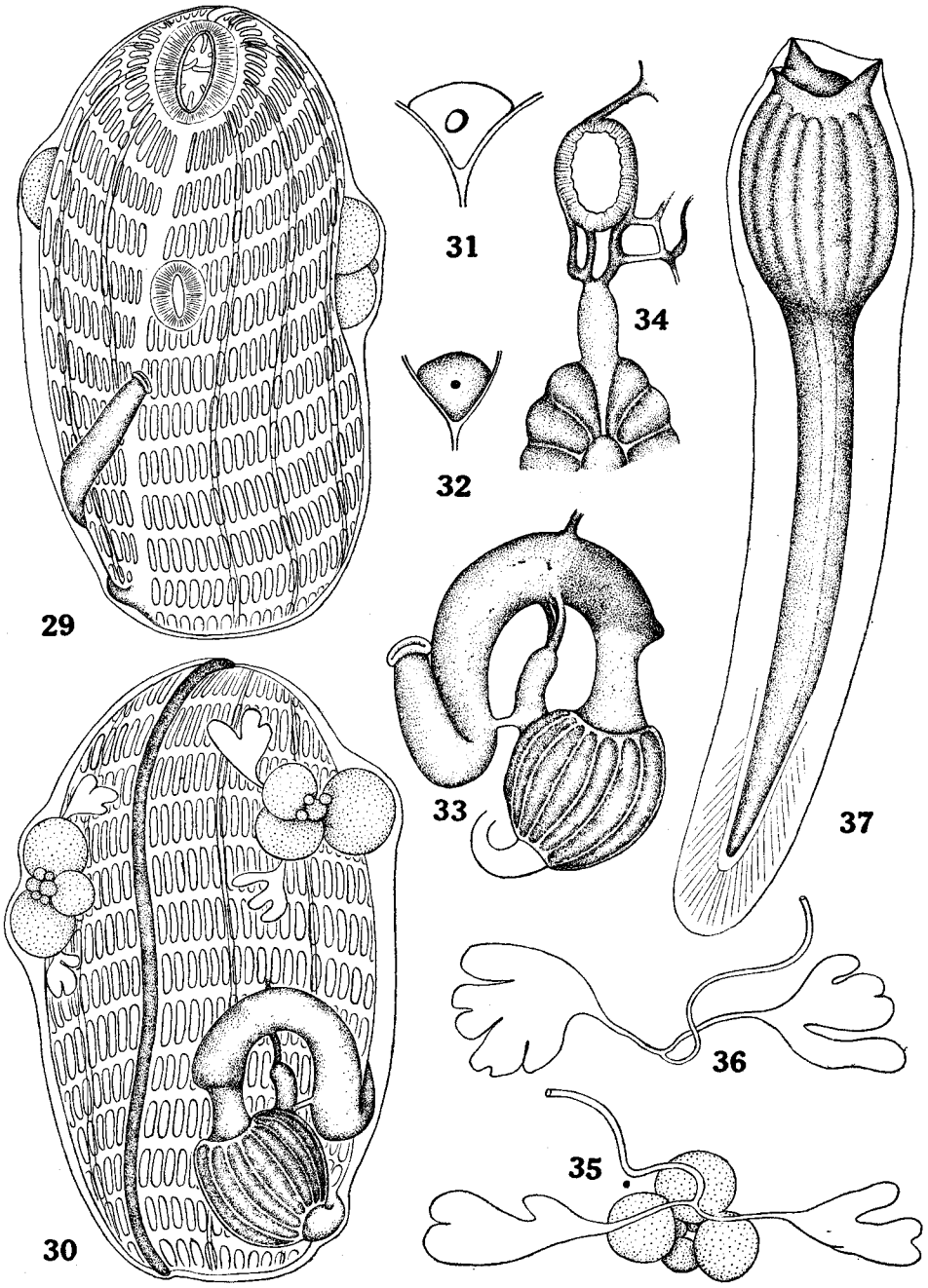


Fig. 7. *Symplegma oceania* n. sp. 29—Dorsal side of a zooid, 30—Ventral side of the same zooid, 31 and 32—Ciliated grooves, 33—Alimentary canal, 34—Pyloric coecum and vessels connecting it to the intestine, seen from the pyloric end of the stomach, above is shown the section of the intestine; 35—Testis and ovary, 36—Lobated testicular lobes, 37—Larva, ×73.

the base and two from the tip; each of the two apical vessels is branched in a way shown in fig. 34 and branches are pigmented in purplish brown and distributed on the intestinal wall of the portion which is coloured somewhat orange. The middle intestine is defined clearly. One gonad on each side. The left gonad is situated at the middle of the range between the anterior end of the intestinal loop and the frontal end of the body and the right gonad is situated slightly anteriorly to the middle of the body, with its posterior margin at just the middle. Testis consists of two lobes, each is cut into two to four lobules which may be then subdivided, these lobules are coloured yellowish orange or reddish orange. Vas deferens is fine, but very long. Ovary is located at the middle between the pair of testicular lobes and usually contains one to three matured ova which are up to 400μ in diameter.

Larva: From two to four tadpole larvae are often found in respective zooids. They are 1.5–1.7 mm in whole length, the trunk is up to 500μ in length. Sixteen elongate ampullae are present, three attachment processes are conical and arranged in a triangle. Larvae are coloured yellowish orange as well as matured ova.

Remarks: The present specimens resemble *Symplegma viride* HERDMAN in the number of stigmatal rows and in some zooids also in that of longitudinal plications on the stomach wall, however the shape of the pyloric coecum differs distinctly between these two. On the other hand, the present species conforms well to *S. reptans* (OKA) in the form of the pyloric coecum, but both the stigmatal rows and longitudinal plications on the stomach are comparatively fewer in *S. reptans* than in the present species. Moreover, the vessels connecting the pyloric coecum to the intestine is quite unique in the present species and this feature seems to be rather constant. For these reasons, the present specimens are considered to represent a new species clearly differentiated from both *S. viride* and *S. reptans*.

8. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* n. sp.

(Pl. V, fig. 3; Text-fig. 8)

Several colonies are found in the collection, two of them are large, respectively 70 mm×50 mm and 50 mm×45 mm in extent, and encrusting the dead barnacles, while others are very small. Larger colonies consist of numbers of considerably large zooids, 18 to 21 mm in length and about 20 mm in height, attaching to one anoter so tightly that their tests are fused one another. Thus, each individual has its own test on the dorsal side and zooids are not wholly embedded in the common test. The test is leathery, thin and about 0.5 mm in thickness, but tough in consistency; it is pale yellowish brown or light grayish brown on the surface and grayish on the inner surface, although it looks dark grayish brown when the mantle body is enclosed within it and the colour of the

mantle is seen through. Both siphons are of a considerable length and distinctly 4-lobed. The surface of the test is generally smooth and exposed, although a little amount of sand and mud are seen deposited along the grooves formed between the zooids. The mantle is thin and coloured lightly in grayish purple brown, but siphons are pigmented rather heavily in dark brown. The branchial siphon is terminal and the atrial siphon is situated slightly posteriorly to the

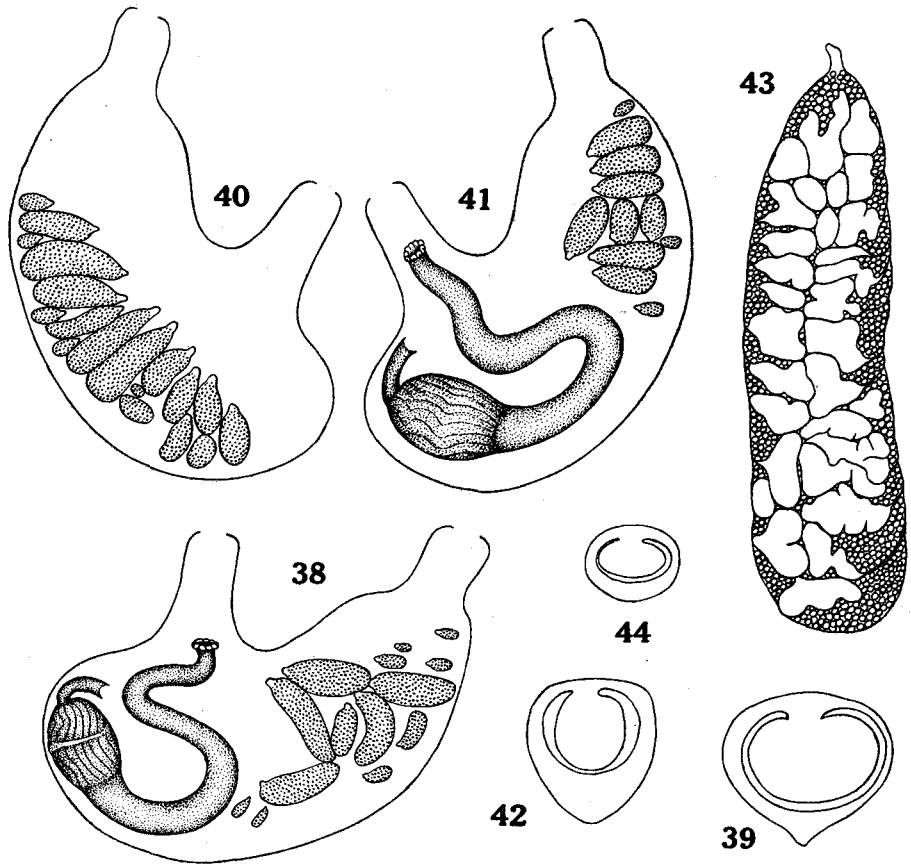


Fig. 8. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* n. sp. 38—Left half of the mantle body of a 18 mm long zooid, inner side; 39—Ciliated groove of the same zooid, 40—Right half of the mantle body of a 21 mm long zooid, inner side; 41—Left half of the same mantle body, inner side; 42—Ciliated groove of the same zooid, 43—A gonad from the same zooid, attachment surface; 44—Ciliated groove of another zooid.

middle of the body, with the anterior edge of its base at just the middle. The atrial tentacles are fine, though very distinct. No endocarps are found on the inner surface of the mantle. The epithelium of the pretentacular stomodaeal

portion is covered densely with small oval swellings which are 630–800μ in diameter and pigmented in dark purplish brown.

Branchial sac: Inner longitudinal vessels are arranged on four folds as follows:

18 mm long zooid											
Left	D.	3	(10)	7	(14)	5	(14)	5	(11)	6	V.
Right	D.	5	(11)	5	(13)	5	(14)	5	(11)	6	V.
21 mm long zooid											
Left	D.	5	(12)	8	(18)	6	(18)	7	(17)	5	V.
Right	D.	5	(11)	6	(16)	6	(17)	6	(13)	8	V.

Transverse vessels are arranged as 1 333 2 333 1 or 1 333 1, here the numerals represent the orders of the thickness; parastigmatic vessels are present, especially found frequently in the posterior part of the branchial sac. Three to four stigmata in each mesh, they are oval or elliptical. Tentacles 22–25, usually the order of large-small-medium-small-large is defined; besides them, minute ones are seen at some intervals. The ciliated groove is simply C-shaped, opened anteriorly.

Alimentary system: The anterior end of the intestinal loop scarcely reaches the middle of the body. The loop is wide; the second loop is distinct, its axis passes through the cardiac or middle part of the stomach. The stomach is elliptical, slightly shorter than a half of the ventral branch of the intestinal loop and furnished on the whole surface with longitudinal plications which are often curved complicatedly and about 10 on the free right surface, but attaining 17 on the whole surface in an examined individual. The pyloric coecum is absent. The anal margin is cut into about ten lobules which may be subdivided.

Gonad: Ten to fourteen gonads on the left and 14 to 22 on the right in dissected 18–21 mm long individuals. They are elongate and may attain 4 mm at the maximum; they are nearly liberated from the mantle, being fastened to it by only a few mesenterial filaments. Testicular follicles are arranged roughly in two rows on the attachment surface, each row consists of 10–12 follicles in larger gonads.

Remarks: The present specimens resemble closely *Polyandrocarpa* (*P.*) *sagamiensis* TOKIOKA 1953 in both the appearance of the colony and the structure and arrangement of internal organs. However, the former is differentiated clearly from the latter in the following three points; (1) the atrial siphon is situated more posteriorly as compared with that of *P. sagamiensis*, (2) the second intestinal loop is distinctly defined and (3) gonads are fewer than in *P. sagamiensis*, especially those on the left side are arranged rather irregularly. Amphipods are often found in the branchial sac. The species is dedicated to Mr. ROLLAND who collected the specimens.

8a. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* f. *solitaria* nov.

(Text-fig- 9)

Six individuals in the collection. They are 13 to 25 mm in body length and 6 to 8 mm in height in larger specimens, elongate ovoid in shape and attached to the substratum by the whole ventral side. Sometimes, the test is grown out as a membraneous extension from the periphery of the attachment surface. The

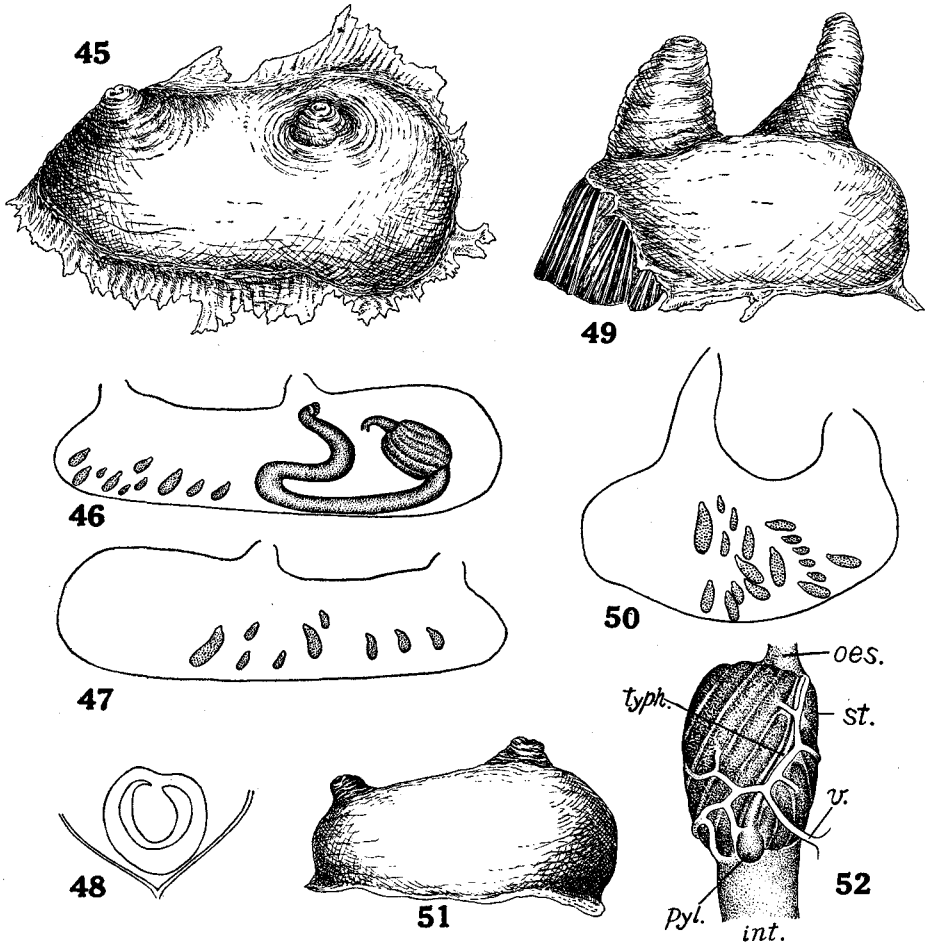


Fig. 9. *Polyandrocarpa* (*Polyandrocarpa*) *rollandi* forma *solitaria* nov. 45—25 mm long individual, 46—Left half of the mantle body of the same individual, outer side; 47—Right half of the same mantle body, outer side; 48—Ciliated groove of the same individual, 49—21 mm long individual, 50—Right half of the mantle body of the same individual, outer side; 51—22 mm long individual, 52—Dorsal side of the stomach of the same individual. int.—intestine, oes.—oesophagus, pyl—pyloric coecum, st.—stomach, typh.—typhlosole, v.—vessel.

branchial siphon is subterminal and the atrial is situated slightly behind the middle of the body with its anterior base at just the middle. Siphons are very short in some specimens, but they may be considerably long in others. The test is thin, less than 0.5 mm in thickness, translucent and light yellowish brown, brownish or grayish white in colour; both siphons are coloured darkly grayish brown. The surface is nearly smooth, but marked with irregularly formed wrinkles on or around the siphons; it is partially covered with mud or encrusted with some compound ascidians. The inner surface bears a pearly glistening. The mantle is very delicate and pale brownish in colour, the siphons are a little darker. The branchial siphon is terminal or subterminal on the mantle body. The pretentacular stomodaeal portion is covered with small oval swellings. Atrial tentacles very fine.

Branchial sac: Eight large, 8 medium-sized and 16 small tentacles are arranged in the order of large-small-medium-small-large; besides, minute ones at some intervals. The ciliated groove is C-shaped, opened anteriorly. Inner longitudinal vessels are arranged as:

22 mm long individual											
Left	D.	5	(12)	6	(14)	5	(13)	6	(10)	6	V.
Right	D.	5	(10)	6	(15)	6	(16)	6	(14)	6	V.
25 mm long indiuidual											
Left	D.	5	(9)	6	(11)	4	(13)	4	(11)	4	V.
Right	D.	4	(9)	5	(12)	4	(13)	4	(11)	5	V.

The dorsal-most inner longitudinal vessel in the first intermediate area between the dorsal lamina and the first fold is situated a little apart from others and slightly thicker. Transverse vessels are arranged in the order of thick-thin-medium-thin-thick and regularly intervened by parastigmatic vessels or partially transverse and parastigmatic vessels alternate rather regularly. Four to five stigmata in each mesh.

Alimentary system: The anterior end of the intestinal loop reaches the middle of the body. The second intestinal loop is very distinct in dorso-ventrally flattened specimens, but it is quite indistinct in globular individuals. The axis of the second loop passes through the pyloric end of the stomach which is oval in shape, smaller than one half of the ventral branch of the intestinal loop and provided with ca. 16 longitudinal plications on the whole surface. The pyloric coecum indistinct in some specimens, but a small but distinct one was observed in a 22 mm long individual. A prominent vessel is issued from the inner edge of the stomach at the level slightly posterior to the middle. The anal margin is cut into lobules, up to 14 in an examined specimens.

Gonad: A 25 mm long specimen has ten gonads on the left and nine on the right side, while another 21 mm long individual is provided on the right side

wth 18 gonads arranged quite irregularly. Larger gonads may attain 4.5 mm in length, testicular follicles are generally arranged in two rows on the attachment surface. All the gonads are nearly liberated from the mantle surface.

Remarks: Evidently, both the external and internal structures of the present specimens conform well to those of zooids of the preceding species, excepting that the present specimens live solitarily. Very probably these are nothing but the solitarily living individuals of the preceding species. Slight differences found in the appearance of the alimentary canal, for example the formation degree of the second intestinal loop and the direction of its axis, seem to be attributable to the shape of the body. It is very difficult to judge which of the solitary form or the colony-forming form is the original form of the present species. If the solitary form is the fundamental form of the species, then the species should be treated as a form of the genus *Polycarpa*, contrarily it must be named as a species belonging to the genus *Polyandrocarpa* (*Polyandrocarpa*) if the colony formation is the general feature in this species. At present, most of specimens were found aggregated so firmly as to form colonies and only several specimens were found solitarily. Thus, it is the more appealing that the colony-forming forms are the original ones of the species and the genus *Polyandrocarpa* (*Polyandrocarpa*) is here adopted for the species.

9. *Polycarpa cryptocarpa* (SLUITER), 1885

(Text-fig. 10)

Styela cryptocarpa—SLUITER, C. PH. (1885): Ueber einige einfache Ascidien von der Insel Billiton. Natuurh. Tijdschr. Ned.-Ind., Vol. 45, pp. 210–215, Pl. 7 figs. 1–3.

Polycarpa cryptocarpa—HARTMEYER (1906): Zool. Anz., Bd. 31, p. 17.

OKA, A. (1915): Mem. Indian Mus., Vol. 6, pp. 17–18, Pl. 1 fig. 13.

HASTINGS (1931): Great Barrier Reef Exped., Sci. Rep., Vol. 4, No. 3, p. 75.

TOKIOKA (1950): Publ. Seto Mar. Biol. Lab., Vol. 1, No. 3, pp. 139–143, text-figs. 16–17, Pl. 10 figs. 2–3.

KOTT (1957): John Murray Exped. 1933–34, Sci. Rep., Vol. 10, No. 4, pp. 145–146.

Pandocia (*Polycarpa*) *cryptocarpa*—MICHAELSEN (1911): Mitt. Naturh. Mus. Hamburg, Vol. 28, p. 152.

A single 75 mm long specimen in the material. The body is considerably flattened laterally and attached to the substratum by the posterior end. The test is leathery, thick, 3–4 mm on most parts and attaining 5 mm near the posterior end, and brownish black in colour. The surface is wrinkled, gooved, and carries various foreign matters; especially some longitudinal grooves are prominent on the surface. The section of the test is grayish purple and the inner surface is also grayish purple and with a kind of pearly glistening. The branchial aperture is terminal, and the atrial aperture is situated near the branchial; both siphons are short and apertures are surrounded by soft purplish black test. The mantle

is very thick, 2–2.5 mm in thickness, and purplish black on the outer muscular layer, while it is dark brownish on the inner layer where gonads are embedded. The inner surface of the mantle and the surface of visceral organs are sprinkled with a number of small roundish vacuoles which are 130–150μ in diameter and purplish black or dark brownish in colour, though they look orange brownish when they are examined in the light field under the microscope. The edge of the atrial velum is fringed with very fine tentacles.

Branchial sac: Tentacles are 22 when only large and medium-sized ones are counted; besides, there are two to three small or minute ones at each interval.

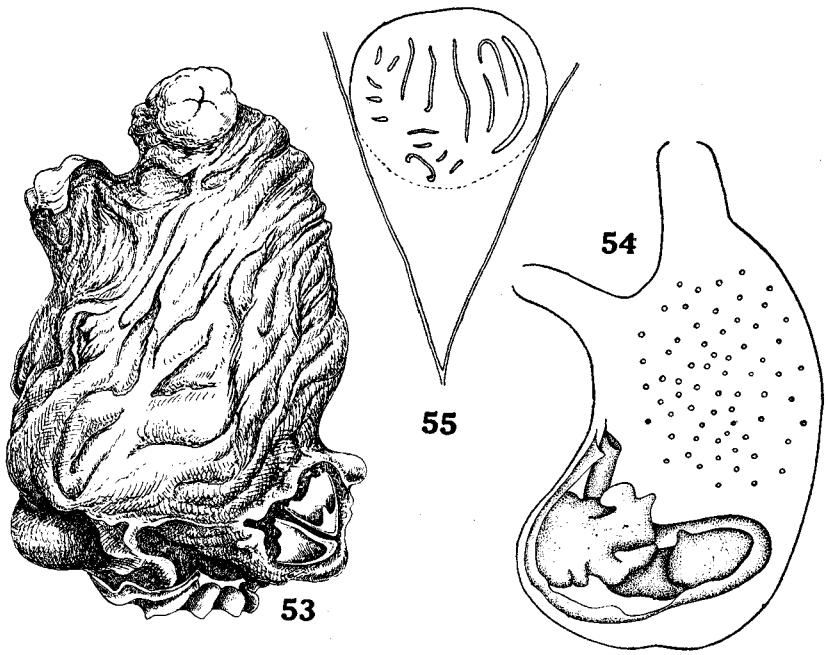


Fig. 10. *Polycarpa cryptocarpa* (SLUITER). 53—75 mm long specimen, 54—Left half of the mantle body, inner side; 55—Ciliated groove.

The ciliated groove is divided into a number of small pieces. Inner longitudinal vessels are arranged as:

Left	D.	2	(16)	4	(20)	6	(19)	5	(16)	4	V.
Right	D.	4	(18)	4	(19)	5	(18)	5	(16)	2	V.

About seven thinner transverse vessels between each pair of thicker ones, parastigmatic vessels present. Up to ten stigmata in a mesh, they may attain 15 in large meshes along the endostyle.

Alimentary system and gonad: Probably the alimentary canal is on the way of regeneration as only the distal portion of the rectum remains perfectly, while

other parts are represented by membraneous fragments. A large endocarp is found in the intestinal loop. The anal margin (?) is cut into a number of lobules. Gonads are distributed evenly on the inner surface of the mantle on both sides, about 65 on the left and about 80 on the right side; they are all buried in the mantle.

10. *Polycarpa aurata* (QUOY et GAIMARD) f. *clavata* HARTMEYER, 1919

(Pl. V, fig. 4; Text-fig. 11)

HARTMEYER, R. (1919): Ascidien in Results of Dr. E. MJÖBERGS Swedish Scientific Expeditions to Australia 1910–13. Kungl. Vet. Akad. Handl., Vol. 60, No. 4, pp. 40–44, Pl. I figs. 17–18.

HARTMEYER & MICHAELSEN (1928): Fauna Südwest-Australiens, Vol. 5, Lief. 6, pp. 363–366, text-fig. 28.

KOTT (1952): Australian Jour. Mar. Freshwater Res., Vol. 3, No. 3, pp. 236–237, text-fig. 46.

There are five specimens of this curious pedunculate styelid collected by Dr. Yves MERLET from the rocky cliff 22 fathoms deep outside the barrier reef near Noumea in October 1958. Three of these specimens were presented to me for examination. They are respectively

	Trunk	Peduncle
No. 1	75 mm long	38 mm long and up to 6 mm thick
No. 2	91 mm long × 36 mm wide	15 mm long
No. 3	85 mm long × 37 mm wide	352 mm long.

The last specimen is preserved most perfectly and shown in Plate V fig. 4 and the second specimen was dissected to examine the inner structure. The peduncle is very short in the first two specimens, but this does not show the whole length of the peduncle, but only a small distal part adjoining to the trunk. The trunk is roughly elongate quadrate in outline, the branchial aperture is situated at the antero-dorsal corner, the atrial aperature is opened on the dorsal side approximately at the level of posterior one-third of the body length and the peduncle is issued from the antero-ventral corner of the trunk. Both siphons are very short, nearly sessile on preserved specimens. The test is soft cartilaginous or rather soft leathery. The surface is quite free from any foreign matters, but provided with several deep longitudinal furrows on each side; besides, a number of irregularly arranged transverse ones are present, thus the surface is divided into many small quadrate areas as seen in the figure of Plate V; the thickness is generally less than 3 mm. The peduncle seems to consist of three parts. For example, the peduncle of No. 3 specimen is described here. The proximal 135 mm (ca. 1/2.6 of the total length) is very hard, being 37 mm in diameter near the basal end, rather stiff in consistency and the surface is covered with many small algae. The distal 37 mm (ca. 1/9.5 of the total length) is of the medium thickness and as

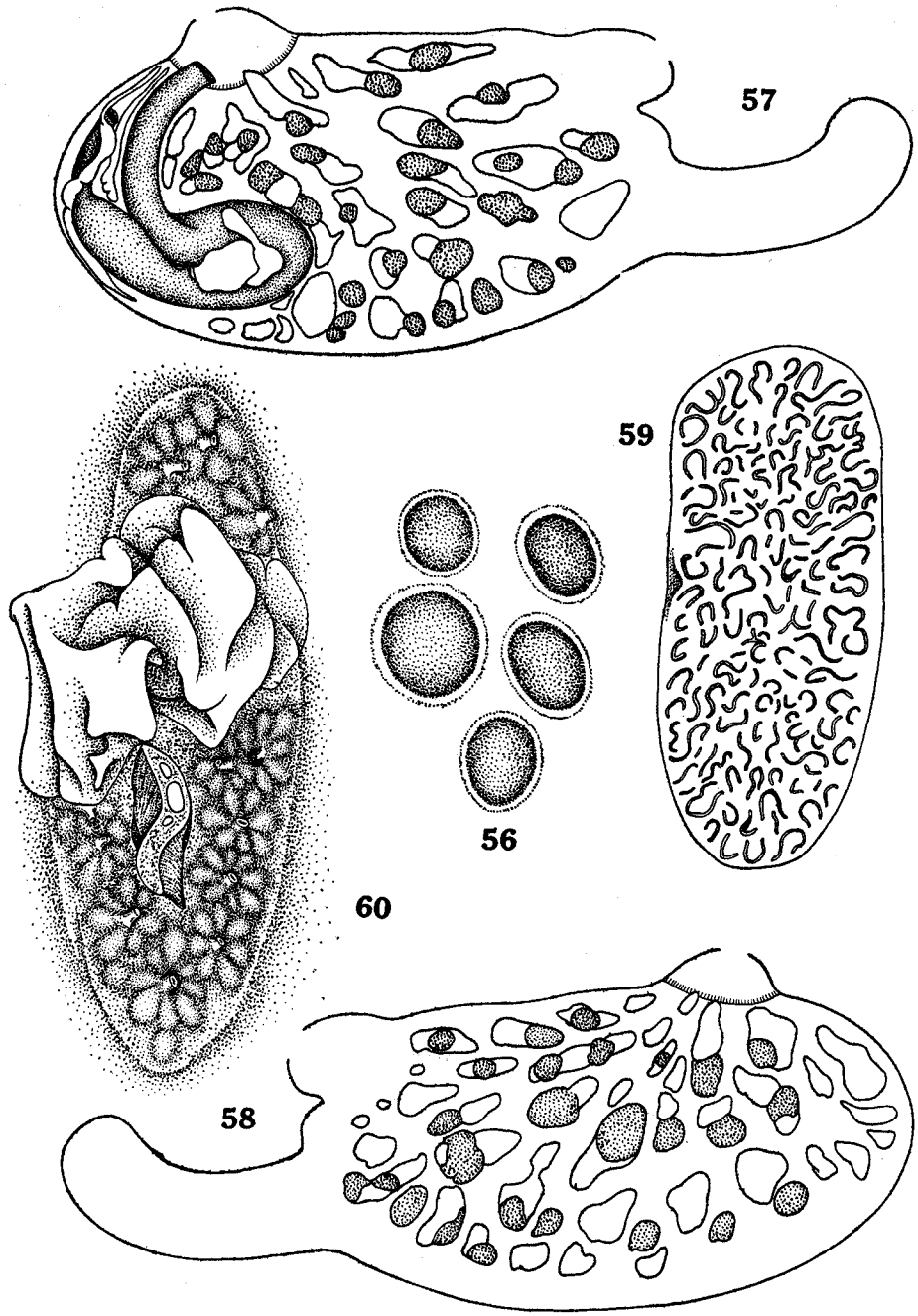


Fig. 11. *Polycarpa aurata* f. *clavata* HARTMEYER. 56—Roundish sensory (?) patches on the peduncular extension of the trunk, enlarged; 57—Left half of the mantle body of the 75 mm long (trunk length) specimen, inner side; 58—Right half of the same mantle body, inner side; 59—5 mm long dorsal tubercle of the same individual, 60—A 10 mm long gonad, a dozen genital apertures are shown on the surface.

evidently the extension of the trunk and provided with a number of small round sensory (?) patches scattered on the surface, these patches are usually ca. 1.5 mm in diameter. The rest 180 mm, about a half of the whole peduncle, is thinner than other parts, very soft and translucent in consistency and quite free from the foreign matters. The whole animal is coloured beautifully in red orange, not only on the external surface of the body but also on the whole internal organs such as branchial sac and alimentary canal, although it is somewhat paler on the soft part of the peduncle. The sensory patches on the distal part of the peduncle are somewhat grayish in colour. According to Dr. CATALA who kept this ascidian alive for a while in his aquarium and made detailed observations on this animal, the animals bore a quite pilose appearance when they were brought from the reef, but after four hours one of the specimens took off the pilose epidermis just as in the moulting. The specimen No. 2 is still holding the pilose epidermis, a gelatinous coat, on the basal half of the trunk. When the epidermis was removed, the coloured test surface looked quite fresh and beautiful*. The animals retained their perfectly erect posture for four days and they were swinging the trunk, just as the carnival doll swings its head with their apertures being alternately opened and closed while they were alive. The mantle is muscular, of a moderate thickness and with a number of endocarps scattered over the inner surface. Fine atrial tentacles are set densely on the atrial velum.

Branchial sac: The inner longitudial vessels are arranged as follows in the specimen No. 1:

Left	D.	4	(20)	5	(22)	5	(24)	4	(22)	3	V.
Right	D.	6	(25)	5	(23)	5	(21)	5	(18)	5	V.

Seven to twelve transverse vessels between each pair of thicker ones, the middle ones of which is usually slightly thicker than others; parastigmatic vessels are present, through they are very delicate; up to 15–20 stigmata in each mesh. Tentacles ca. 30 in No. 1 specimen, larger and smaller ones are differentiated and minute ones intervene at intervals. The dorsal tubercle is elliptical in shape and very large, about 5 mm in length; the ciliated groove is cut into about 140 small pieces in No. 1 specimen.

Alimentary system: The alimentary carnal is situated in the posterior one third of the left side and figures a S-shaped loop. The second intestinal loop is very distinct and its axis passes through the pyloric portion of the stomach which is elongate, slender and provided with ca. 25 longitudinal plications on the wall. These plications are, hower, invisible from the surface; pyloric coecum absent.

* As to the moulting found in ascidians, K. KISHINOUYE (1894) stated that a specimen of *Halocynthia roretzi* DRASCHE was found moulting in the Inland Sea; the epidermis casted off was wrinkled and dirty brownish in colour, while the fresh test surface was bright reddish in colour (Zoological Magazine, Tokyo, Vol. 6, p. 342).

The anus is plainly margined. Two large endocarps are found in the first intestinal loop.

Gonad: In No. 1 specimen, there are ca. 35 gonads on the left and ca. 40 on the right side. Each gonad comprises a number of testes consisting respectively of several testicular follicles and having each a short duct. Usually one or two endocarps are found attached to the gonad.

Remarks: Although the remarkable colouration of those specimens and the existance of so long peduncle in some of the specimens fascinated me considerably, it is very evident that these are f. *clavata* of *Polycarpa aurata* (QUOY et GAIMARD) described by HARTMEYER originally from North West Australia.

11. *Cnemidocarpa areolata* (HELLER), 1878

(Text-fig. 12)

Cnemidocarpa irma—HARTMEYER & MICHAELSEN (1928): Fauna Südwest-Australiens, Bd. 5, Lief. 6, pp. 388–393, text-figs. 40–42.

Styela (*Cnemidocarpa*) *irma*—KOTT (1952): Australian Jour. Mar. Fresh-water Res., Vol. 3, No. 3, pp. 217–218, text-fig. 11.

Six specimens are found in the collection. Two small individuals, respectively 4.5 mm and 8 mm in length, are devoid of any gonads and wear the thin whitish test, while other four 14 to 26 mm long individuals are provided with gonads of various grades of maturity. The body is roughly ovoid; the branchial aperture is terminal and the atrial is situated near or slightly in front of the middle of the body; both siphons are very short. The side of attachment is rather variable, some may be attached by the right ventral side. The test is soft cartilaginous, but tough, yellowish white or yellowish brown in colour and the surface is nearly smooth in some specimens, but may be grooved just as in *Styela plicata* in others. It is 1–2 mm thick, the inner surface is coloured as on the outer surface. The mantle is not thick, reddish brown in colour. The atrial siphon is located with the posterior edge of its base at the middle of the mantle body. Atrial tentacles are present. A few endocarps on the inner surface of the right side and a considerable number of them are arranged along the alimentary canal on the left side. Usually several endocarps are found in the intestinal loop. The swelling of the subneural gland is seen very distinctly on a 15 mm long individual.

Branchial sac: Inner longitudinal vessels are arranged as:

14 mm long specimen

Left	D.	4	(9)	4	(11)	4	(11)	4	(9)	0	V.
Right	D.	0	(8)	4	(10)	4	(9)	4	(8)	3	V.

23 mm long specimen

Left	D.	3	(11)	4	(13)	4	(14)	4	(11)	4	V.
Right	D.	0	(13)	3	(13)	4	(13)	3	(12)	4	V.

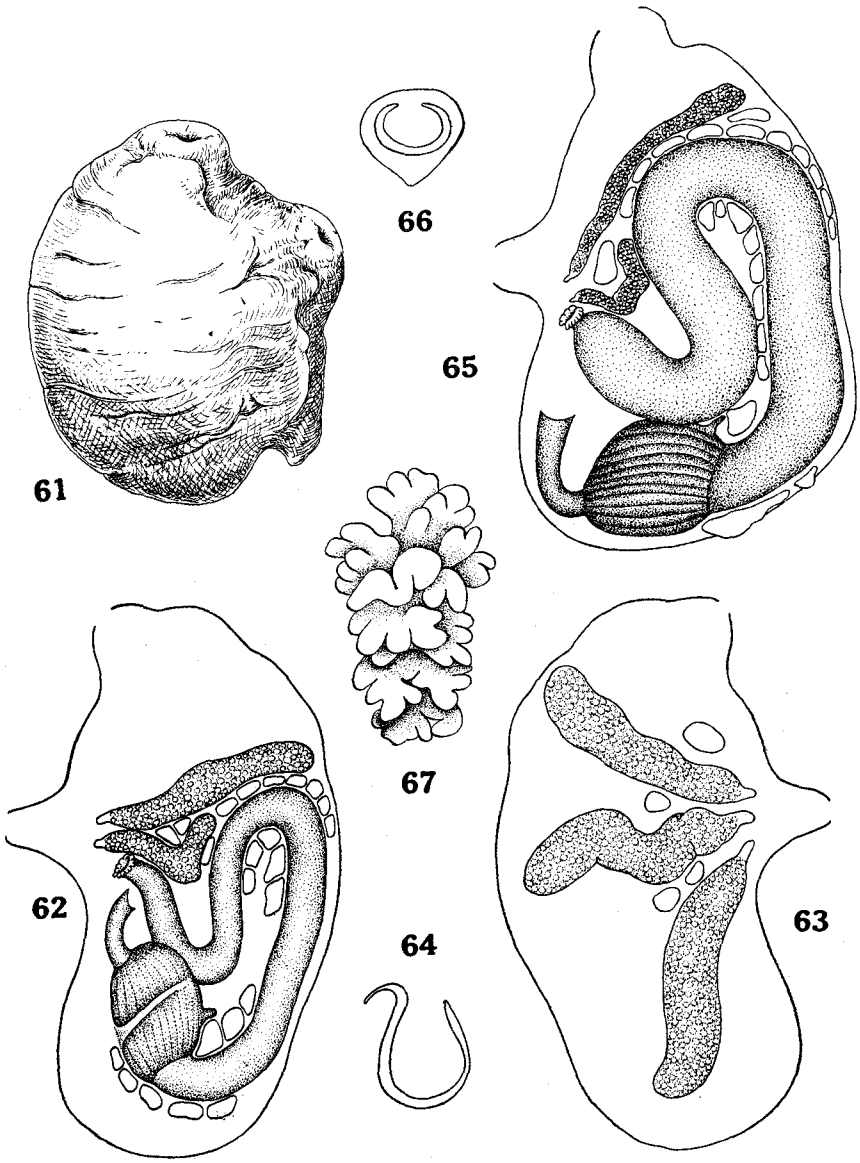


Fig. 12. *Cnemidocarpa areolata* (HELLER). 61—A 23 mm long specimen, left side; 62—Left half of the mantle body of the same individual, inner side; 63—Right half of the same mantle body, inner side; 64—Ciliated groove of the same individual, 65—Left half of the mantle body of a 14 mm long individual, inner side; 66—Ciliated groove of the same individual, 67—Swelling of the subneural gland of a 15 mm long individual, enlarged.

Three thinner transverse vessels are found between each pair of thicker ones, parastigmatic vessels are mostly found in the posterior part of the sac. Five to seven stigmata in each mesh, but they may be up to 9 in larger meshes along the endostyle. Tentacles 21–24 in examined specimens, the order of the arrangement is 1 3 2 3 1, here the numerals indicate the orders of the thickness. Ciliated groove is simply U or C-shaped opened anteriorly.

Alimentary system: The anterior end of the intestinal loop reaches the level of the base of the atrial siphon or beyond it to the middle of the range between both siphons. The second loop is very distinct, its axis passes through the pyloric portion of the small globular stomach which is longitudinally plicated (with about a dozen plications on the free right surface) and with a tiny pyloric coecum. The anal margin is cut into ca. 15 lobules.

Gonad: Three elongate gonads on the right and two on the left. The left posterior gonad never proceeds into the second intestinal loop and this feature differs distinctly from that found in *Styela plicata.*

Remarks: *Cnemidocarpa valborg* HARTMEYER 1919 and *Cnemidocarpa irma* HARTMEYER & MICHAELSEN 1928 are evidently considered to be identical with the present species. The existence of only three gonads on the right side is common to the present specimens, the Palao specimens described by TOKIOKA (1950) and those described by KOTT (1952). However, the occurrence of fewer gonads may be attributable to the smallness of those specimens rather than to be regarded as a characteristic of some taxonomic significance.

12. *Styela partita* (STIMPSON), 1852

(Text-fig. 13, Table 1)

?*Styela rectangularis*—KOTT, P. (1952): The Ascidians of Australia I. Stolidobranchiata LAHILLE and Phlebobranchiata LAHILLE. Australian Jour. Mar. Freshwater Res., Vol. 3, No. 3, pp. 224-226, text-figs. 27-29.

In all 104 specimens in the material; they range from 2 mm to 17 mm in body length, but most frequently 6–12 mm. The body shape varies considerably, some are erect, ellipsoidal and attached to the substratum by the left posterior part of the body, while others are roughly globular or ellipsoidal and lying with the whole ventral side beneath. The branchial aperture is usually terminal in the erected ellipsoidal or globular individuals, but rather subterminal in lying individuals. The situation of the atrial siphon varies from the middle of the body to the level of the anterior one third. Both apertures nearly sessile and siphons are quite short in the preserved specimens. The test is leathery, yellowish brown or reddish brown on the surface, being somewhat darker on the dorsal side, but whitish on the inner surface. It is rather thick and about 0.5 mm in thickness in contracted specimens, but very thin in extended ones. The surface is nearly

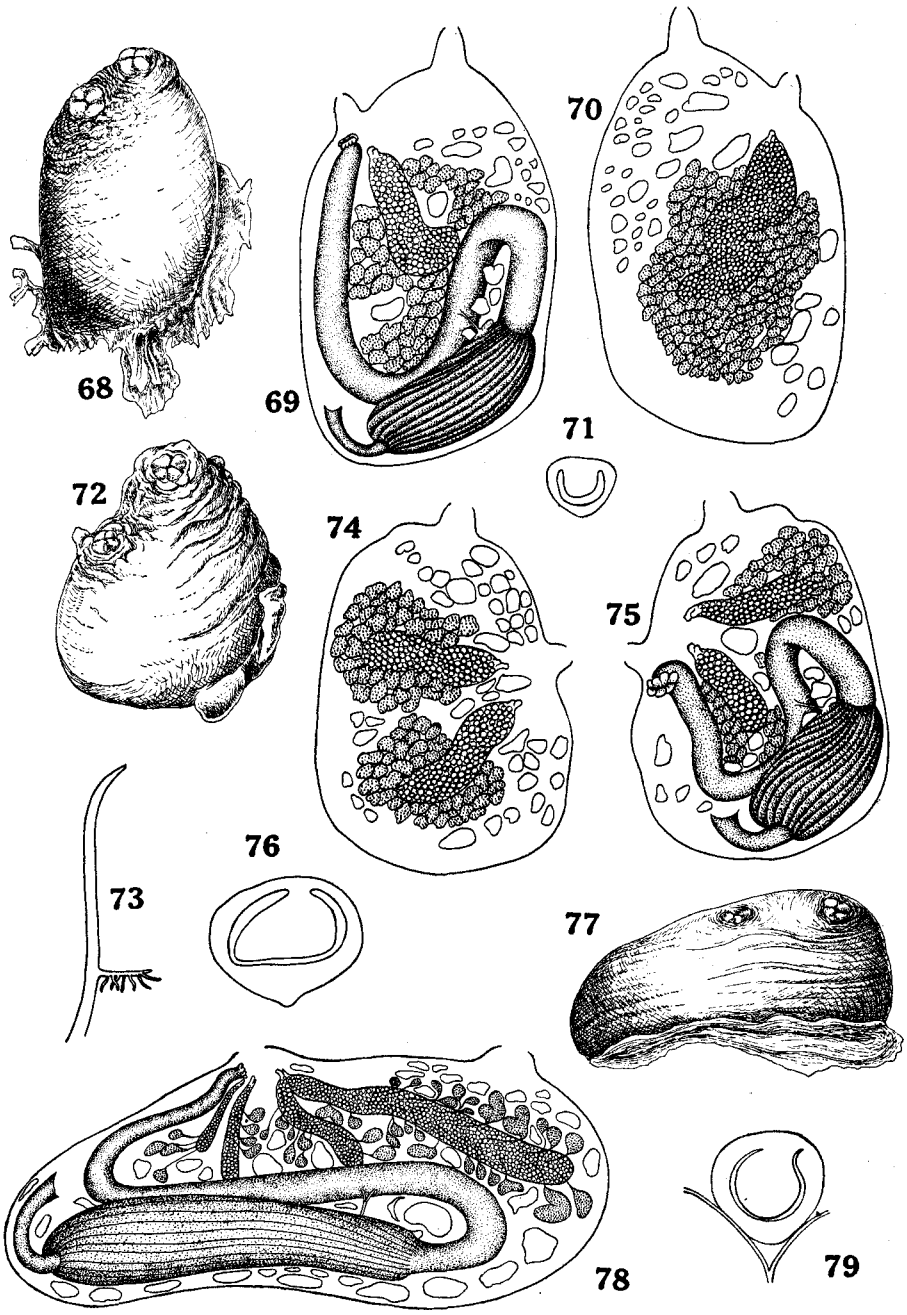


Fig. 13. *Styela partita* (STIMPSON). 68—A 14 mm long individual, 69—Left half of the mantle body of the same individual, inner side; 70—Right half of the same mantle body, inner side; 71—Ciliated groove of the same individual, 72—A 13 mm long individual, 73—Schema of the optical section of the wall of the atrial siphon, showing the villose atrial velum, 74—Right half of the mantle body of the same individual, inner side; 75—Left half of the same mantle body, inner side; 76—Ciliated groove of the same individual; 77—The 13 mm long elongate lying specimen, 78—Left half of the mantle boody of the same individual, inner side; 79—Ciliated groove of the same individual.

smooth in extended specimens, but wrinkled or irregularly corrugate in contracted ones. The mantle is light reddish brown or purplish brown in colour, usually darker on the dorsal side and varies in thickness according to the state of contraction. The inner surface of the atrial velum is densely set with fine tentacular prominences (text-fig. 13, *73*). Many endocarps are scattered on the inner surface on both sides.

Branchial sac: The tentacles are fundamentally composed of 8 large, 8 medium and 16 small or minute ones, thus 32 in all, arranged in the order of large-small-medium-small-large. The ciliated groove is C-shaped opened anteriorly. Inner longitudinal vessels are arranged as:

13 mm long specimen											
Left	D.	2	(11)	2	(10)	2	(13)	2	(10)	1	V.
Right	D.	3	(13)	2	(10)	2	(12)	2	(9)	1	V.
13 mm long specimen											
Left	D.	3	(14)	3	(12)	3	(12)	3	(9)	2	V.
Right	D.	3	(16)	2	(13)	3	(14)	3	(10)	2	V.
14 mm long specimen											
Left	D.	2	(12)	3	(9)	2	(13)	2	(8)	2	V.
Right	D.	4	(12)	3	(10)	3	(10)	3	(8)	1	V.

Thicker and thinner transverse vessels alternate regularly or they are found arranged in the order of 1 3 2 3 1, the numerals indicate the orders of the thickness; parastigmatic vessels are usually found in the posterior part of the sac. Four to seven very elongate stigmata in each mesh, they may be up to 12 in larger ones along the endostyle.

Alimentary system: The intestinal loop is very prominent and with the very distinct second loop, the axis of which passes through the cardiac end of the stomach or the oesophageal region. The stomach is elongate, marked with 10–12 longitudinal plications on the right free surface and has a minute pyloric coecum. The length of the stomach is always larger than one half of the ventral branch of the intestinal loop. The whole alimentary canal is relatively short in globular or erected ellipsoidal individuals, and consequently the stomach is not so long, while the whole canal is generally very long and the stomach is also extremely elongate in those which are lying along the ventral side (text-fig. 13, *78*). In the latter, the vessel connecting the inner pyloric part of the stomach with the intestine is issued from the level fairly in front of the coecum, this vessel is generally issued from the anterior base of the coecum on shorter stomachs. The anal margin is cut into 8–10 lobules.

Gonad: Usually two gonads on each side. Ovaries are elongate and testes are spread around the ovaries. Rarely one or both gonads are missing on one or

Table 1. *Styela partita* (STIMPSON) Occurrences of various numbers of gonads in the present material.

Number of gonads / Body length	Left 4 Right 2	Left 2 Right 2	Left 2 Right 1	Left 2 Right 0	Left 1 Right 2	Left 1 Right 1	Left 0 Right 2	Left 0 Right 1	Left 0 Right 0	Mutilated	Total
17 mm		1			1						2
16		2									2
15		5									5
14		2				1					3
13	1	4									5
12		14								1	15
11		8	1								9
10		10	1		1		1			1	14
9		16	1	1							18
8		9									9
7		5			2				1		8
6		5							1	1	7
5		2						1			3
4		1						1			2
3		1									1
2									1		1
Total	1	85	3	1	4	1	1	2	3	3	104

both sides as seen in Table 1. The most strange is the 13 mm long elongate individual shown in text-fig. 13, *78*; this is provided with four gonads on the left side, the anterior two of them are united into one near the apertures. At a glance on the internal structure of this specimen, I thought immediately of *Cnemidocarpa macrogastra* (OKA) and *Cnemidocarpa personata* (HERDMAN), because it was provided with four gonads and a very elogate stomach on the left side. However, the details of the structure are exactly the same as those of other specimens and every extreme feature, exclusive of gonads, is quite continuous to the ordinary one. The existence of four gonads must be a remarkable abnormality.

In most of individuals less than 5 mm gonads are still immature, although a 3 mm long individual was found with semimatured gonads in which the testes were coloured red and one of the 5 mm long individuals was found fully matured. Contrarily, a single 12 mm long individual was found with only rudimentary gonads.

Remarks: *S. rectangularis* KOTT 1952 conforms very well to the present species in every detail. It is not impossible that both species are quite identical with each other.

13. *Herdmania momus* (SAVIGNY), 1816

(Text-fig. 14)

Thirty-four specimens in all, they are 5–49 mm in length and those smaller than 8 mm long are not yet provided with any gonads. The test is soft cartilaginous, but tough enough; it is usually 1–1.5 mm thick in larger specimens, but up to 3 mm at some posterior portions. The surface is originally smooth, but becomes wrinkled or grooved by contraction, and sometimes it is covered with the nest tubes of polychaetes and hydrozoan colonies. The surface is pale grayish brown. The mantle is light grayish purple with a reddish tint at the tip of siphons in fresh specimens, but the colouration fades to light reddish brown with time. The consistency is rather soft. Large spicules attain 1 mm in length. The anterior end of the intestinal loop reaches near the anterior end of the body. The axis of the second intestinal loop passes through approximately the distal end of the gastric region. The anal margin is plain. Eight plications, eight and one rudimentary plications or nine ones on each side of the branchial sac. Eighteen large and medium-sized tentacles are found in a dissected 43 mm long individual; besides, one or two small ones are present at intervals; branches in 3 orders. The ciliated groove is rosette-formed in all examined specimens. Thus, all of the present specimens seem to belong to the ordinary shallow water form of the species and none of the variety *grandis* (HELLER) characteristic to Australian waters was found in the material.

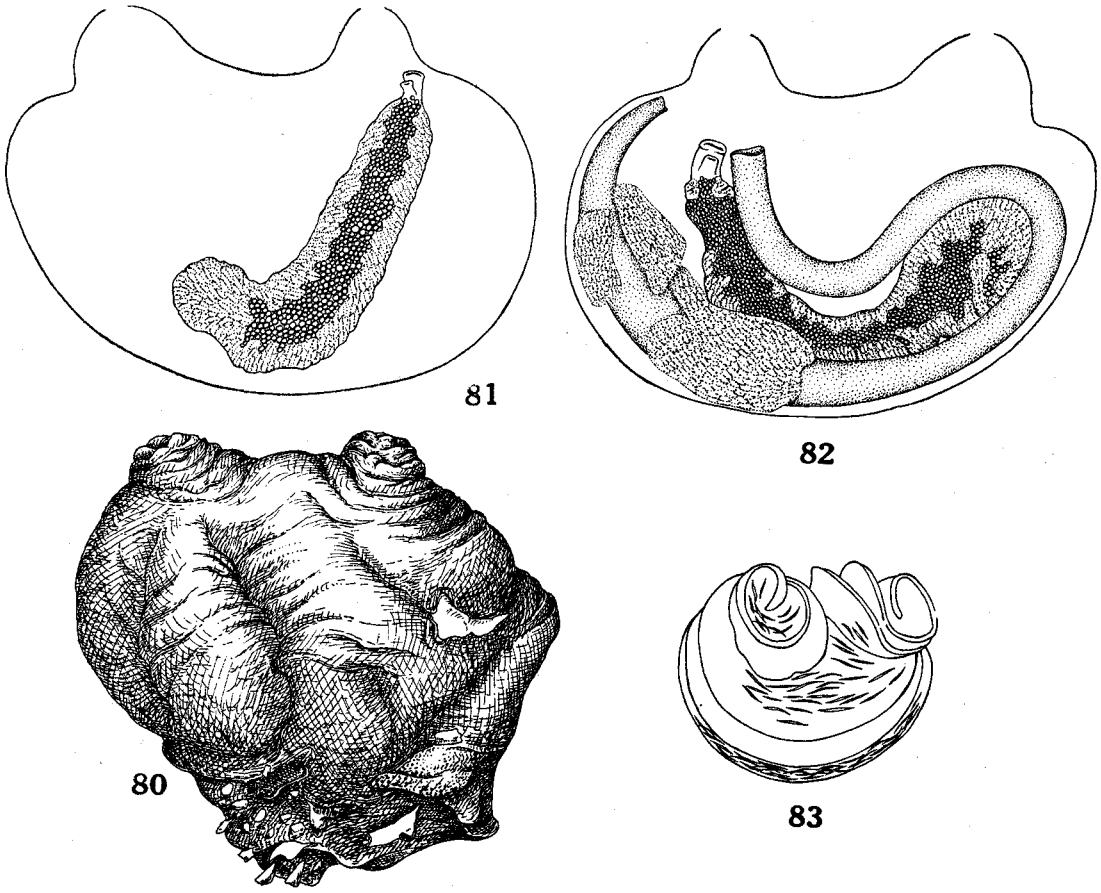


Fig. 14. *Herdmania momus* (SAVIGNY). 80—A 43 mm long specimen, 81—Right half of the mantle body of the same individual, inner side; 82—Left half of the same mantle body, inner side; 83—Ciliated groove of the same individual.

14. *Microcosmus* sp. aff. *multiplicatus* TOKIOKA, 1952

(Pl. V, fig. 5; Text-fig. 15)

TOKIOKA, T. (1952): Ascidans collected by Messrs. RENZI WADA and SEIZI WADA from the pearl-oyster bed in the Arafura Sea in 1940. Publ. Seto Mar. Biol. Lab., Vol. 2, No. 2, pp. 132–134, text-fig. 26.

Eight 19 to 32 mm long specimens in the collection. The body is roughly ovoid and attached to the substratum by the ventral, postero-ventral or left postero-ventral side. The branchial siphon is terminal and the atrial is situated approximately at the middle of the dorsal side, both siphons are strongly contracted in preserved specimens. The test is hard leathery, very tough and up to 1 mm thick on the dorsal side, but very thin on the attachment surface. It is usually pinkish brown or reddish brown, although rarely it may be yellowish brown. Originally the surface is smooth, but wrinkled or irregularly corrugate by contraction and may carry mud or some foreign materials on some parts. The siphons are, however, always strongly corrugate and coloured darkly. The inner surface is lighter in colouration. The inner surface of the distal part of both branchial and atrial siphons is armed densely with minute conical spinules, 30–45μ in length, while that of the proximal part is very soft and furnished rather sparsely with very fine tentacular prominences, about 260μ in length (text-fig. 15, *88*). The mantle is of a moderate thickness and furnished with a well-developed musculature, it is dark brownish red or reddish brown and with a purplish hue. The mantle adheres very firmly to the soft somewhat gelatinous inner layer of the test.

Branchial sac: Tentacles 16 when the larger and medium-sized ones are counted; besides, a smaller one at each interval; branches in 2 or 3 orders, those of the third order are very scarce. Branchial plications are:

19 mm long individual	left 9	right 10
20	10	10
21	9	11
26	9	10
27	9	10
27	9	9
32	10	12
32	10	11

One or two ventral ones are rudimentary and defined only in the anterior part of the sac. Inner longitudinal vessels are:

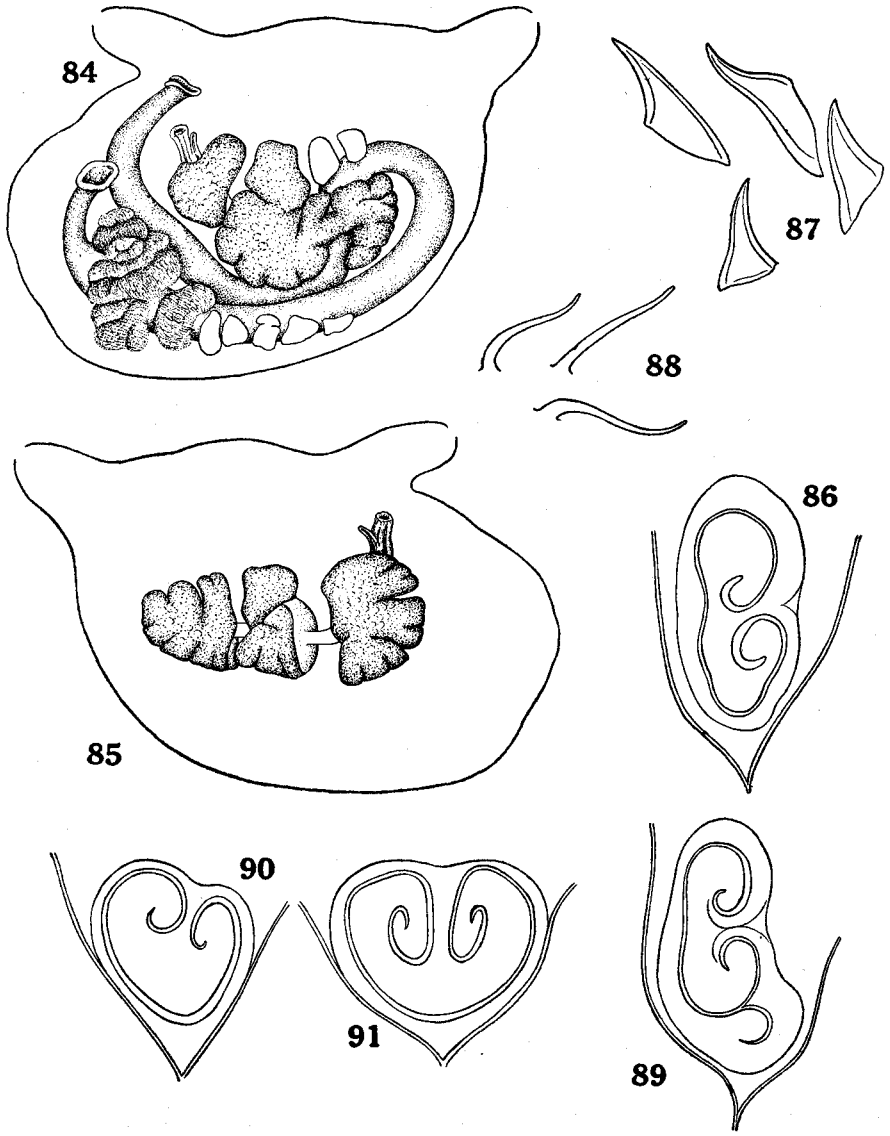


Fig. 15. *Microcosmus* sp. aff. *multiplicatus* TOKIOKA. 84—Left half of the mantle body of a 32 mm long individual, inner side; 85—Right half of the same mantle body, inner side; 86—Ciliated groove of the same individual, 87—Spinules on the distal part of the stomodaeum, ×440; 88—Filamentary prominences on the inner part of the stomodaeum, ×73; 89—Ciliated groove of another 32 mm long individual, 90—Ciliated groove of a 27 mm long individual, 91—Ciliated groove of a 26 mm long individual.

the last one of the above list

Left	D.	3	(24)	4	(24)	3	(32)	4	(28)	4	(26)
		4	(25)	3	(22)	1	(17)	1	(17)	1	(12)
		0	V.								
Right	D.	3	(23)	2	(25)	3	(30)	4	(28)	4	(28)
		3	(27)	3	(25)	1	(22)	1	(21)	1	(18)
		1	(13)	1	V.						

Transverse vessels are arranged partly in the order of 1 4 3 4 2 4 3 4 1, here the numerals indicate the orders of the thickness, parastigmatic vessels present. Stigmata are rather small and usually 3–4 ones are found in each mesh. The ciliated groove is C-shaped with both horns incurled, it is opend

anteriorly in one individual (26 mm long),
obliquely in five individuals (19, 20, 21, 27, and 27 mm long),
and
laterally towards the right in two individuals (both 32 mm long).

This feature reminds us of that found in *Microcosmus hartmeyeri* OKA in the Japanese waters.

Alimentary system: The bottom of the second intestinal loop touches the middle of the ventral branch of the first loop, the position fairly posterior to the gastric region furnished with hepatic lobes. Liver is orange brown or yellowish brown in colour, hepatic lobules are each provided with several minute papillae. The anal margin is plain. Several endocarps are arranged in a row on the ventral wall of the proximal portion of the intestine and a few ones on the dorsal wall of the proximal part of the dorsal branch of the loop and also on the intestinal wall at the bottom of the second loop in some specimens.

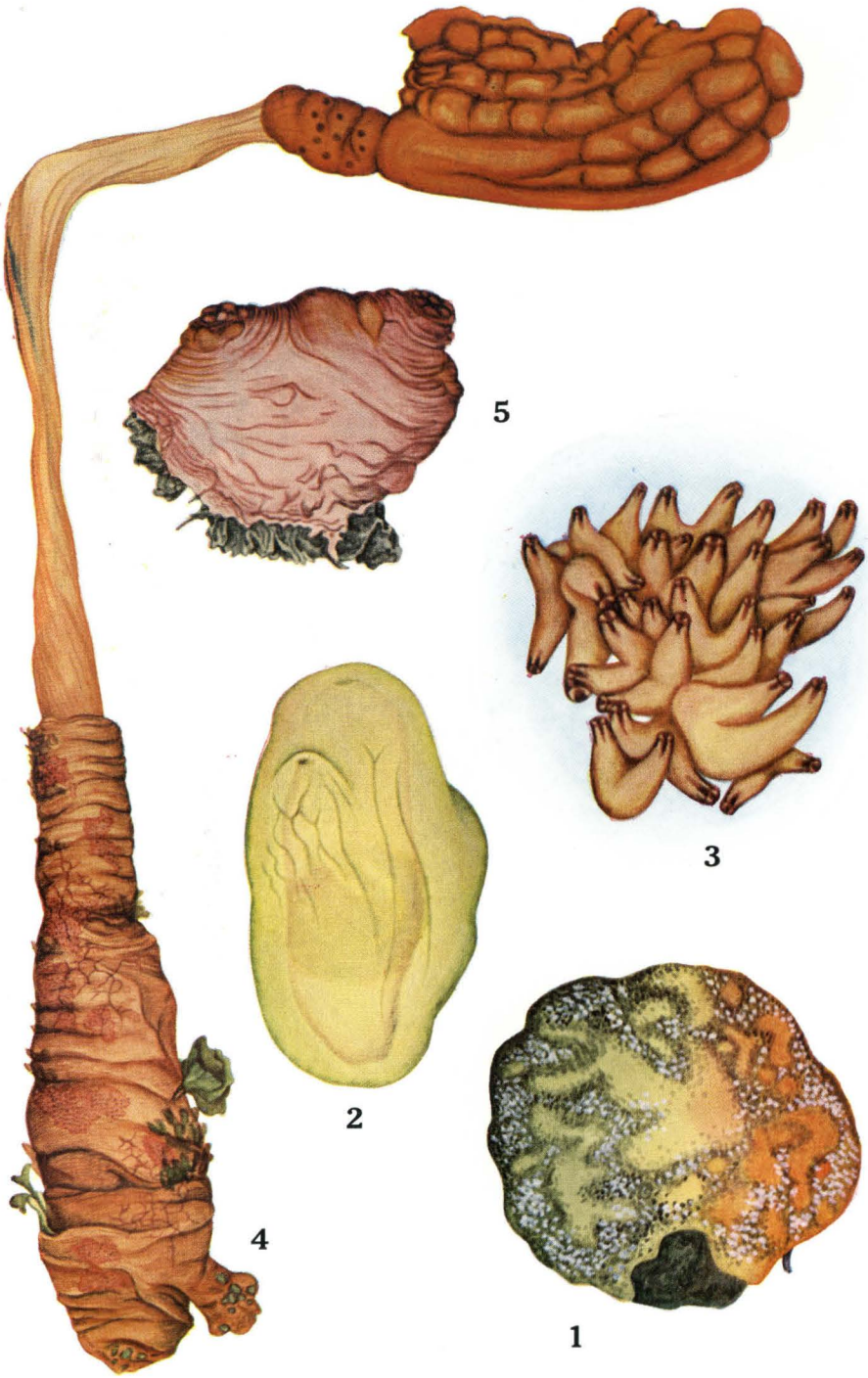
Gonad: A single gonad on each side, it consists of three genital capsules and the anterior-most capsule of the left gonad is located in the first intestinal loop. The 20 mm long specimen is devoid of gonad on the right side.

Remarks: These specimens are provided with rather numerous branchial plications and this feature resembles closely that of *M. multiplicatus* TOKIOKA described on a single specimen from the Arafura Sea. On the other hand, *M. multiplicatus* itself and also the present specimens are related very closely with *M. exasperatus* HELLER occurring very commonly in the tropical Pacific waters which is usually provided with 7–9 branchial plications on each side. Indeed, the gap found in the number of branchial plications is the only distinct clue separating *M. multiplicatus* and *M. exasperatus* from each other. At present, it is very hard to find out whether the number of plications is quite continuous between these two species or there are two distinctly different modes when the number

of plications is examined on a number of specimens of these two species collected at various localities. For this reason, it is practically impossible to decide right now the validity of *M. multiplicatus* and thus the present specimens are treated provisionally as the form affined to *M. multiplicatus*.

EXPLANATION OF PLATE V

1···*Polyclinum constellatum* SAVIGNY, a colony with a 45 mm diameter; two colour types are shown on the same colony.
2···*Phallusia julinea* SLUITER, the 51 mm long specimen.
3···*Polyandrocarpa* (*Polyandrocarpa*) *rollandi* n. sp., the living 70 mm × 50 mm colony.
4···*Polycarpa aurata* f. *clavata* HARTMEYER, the living 85 mm long (trunk length) individual with the peduncle 352 mm in length.
5···*Microcosmus* sp. aff. *multiplicatus* TOKIOKA, the 32 mm long specimen.



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